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Published in:
Applied Geography

DOI:
[10.1016/j.apgeog.2019.03.004](https://doi.org/10.1016/j.apgeog.2019.03.004)

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Document Version
Publisher's PDF, also known as Version of record

Publication date:
2019

[Link to publication in University of Groningen/UMCG research database](#)

Citation for published version (APA):

Stoffelen, A., Groote, P. D., Meijles, E., & Weitkamp, G. (2019). Geoparks and territorial identity: A study of the spatial affinity of inhabitants with UNESCO Geopark De Hondsrug, The Netherlands. *Applied Geography*, 106, 1-10. <https://doi.org/10.1016/j.apgeog.2019.03.004>

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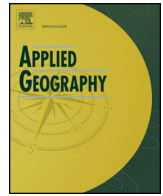
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Geoparks and territorial identity: A study of the spatial affinity of inhabitants with UNESCO Geopark De Hondsrug, The Netherlands

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ARTICLE INFO

Keywords:

Landscape associations
Regional identity
Regional development
Environmental resource management
Mental maps
GIS

ABSTRACT

Even though the societal and academic attention to geoparks is on the rise, there is a distinct absence of studies on communities and their perceptions of the landscapes institutionalized by geoparks. This paper contributes to the geopark literature by problematizing the geographical awareness, landscape associations and territorial identities of geopark inhabitants. Using a quantitative case study of UNESCO Geopark De Hondsrug (the Netherlands), the paper shows a complex image regarding the inhabitants' affinity with their living environment. At its initiation, the geopark did not build on the landscape associations of local inhabitants. Composite overlap mapping of mental maps drawn by inhabitants shows that the geopark incorporates an area that is substantially larger than the area interpreted by the inhabitants as constituting the Hondsrug. Nevertheless, the core area of the Hondsrug is recognized and lived by the majority of the people, providing a starting point for improving the community's support for the geopark's brand. We conclude that only when there is enough bottom-up recognition and embedding of the brand and its underlying landscape values, a geopark's narrative can be effectively built on for endogenous regional development purposes.

1. Introduction

Geoparks are increasingly important strategies in rural areas to achieve endogenous regional development through geo(morpho)logical heritage conservation and geotourism development. As defined by UNESCO (2017),

“Geoparks are single, unified geographical areas where sites and landscapes of international geological significance are managed with a holistic concept of protection, education and sustainable development.”

Since the 1990s, geoparks have rapidly established as societal institutions. The underlying philosophy was coined in 1991, followed in 1997 by a discussion to develop a UNESCO Geoparks Programme. Even though this programme was ultimately not formalized, several networks developed soon after with formal collaboration agreements with UNESCO, most notably the European Geoparks Network (EGN) in 2000 and the Global Geoparks Network in 2004 (Jones, 2008). All EGN members were awarded the UNESCO Global Geopark status in 2015. The academic attention to geoparks has grown in parallel to this trend. A Scopus search for international journal articles containing ‘geopark’ in the title, abstract or keywords resulted in 466 published articles since

2002, with a strong increase in the last decade (Fig. 1).

Despite the growing field of study, a notable mismatch is present between the aims of geoparks and the dominant research perspective on this topic. Geoparks aim to protect, manage and promote landscapes of outstanding value with three main aims: geoheritage conservation, education of visitors through geotourism activities and of residents with information provision, and achieving sustainable or endogenous economic development (Avelar, Mansur, Anjos, & Vasconcelos, 2015; Azman, Halim, Liu, & Komoo, 2011). Considering these aims, and despite UNESCO explicitly calling for a bottom-up approach to empower local communities in geoparks (UNESCO, 2017), it is surprising that community perspectives are largely absent in academic geopark studies. In these studies, the physical landscape rather than its community embedding is the predominant object of study, thereby assuming that geopark landscapes are intrinsically valuable and increased education improves the community's awareness of the value of geoparks. Such an approach has led to remarks that “in many ways, geoparks are similar to zoos and museums and serve as centres for informal learning” (Buhay & Best, 2015, p. 165). Such objectified visions on landscapes disregard that geoparks are not neutral landscapes but places lived in and experienced by local communities, and that these communities have a spatial affinity and regional identity that is created in mutual

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<https://doi.org/10.1016/j.apgeog.2019.03.004>

Received 17 December 2018; Received in revised form 26 February 2019; Accepted 5 March 2019

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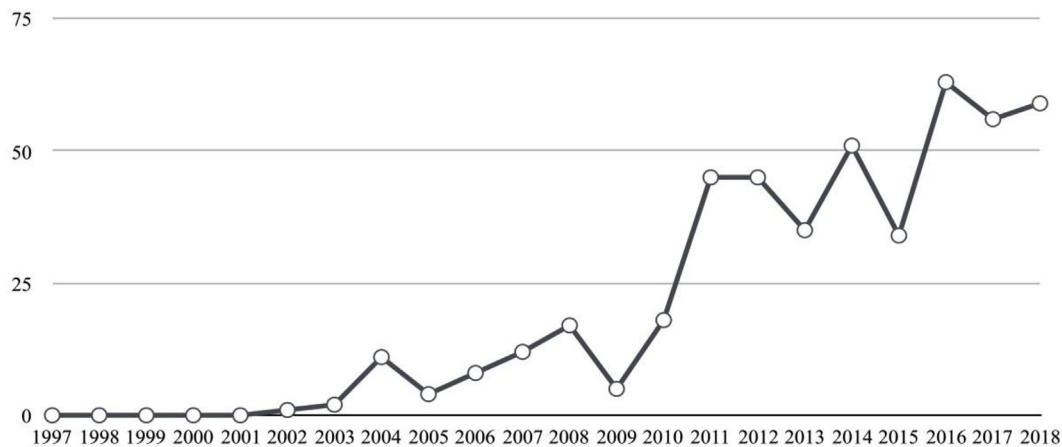


Fig. 1. Evolution of the number of publications on geoparks as registered in Scopus.

interaction with these landscapes (Kolen & Renes, 2015; Popa, Popa, & Andrașanu, 2017).

We argue that the geographical awareness of geoparks' inhabitants should be problematized to further our knowledge on the role of geoparks as endogenous development drivers. Are people actually aware of the physical and socio-cultural spatial environment in which they live? Is there an intangible connection of people with the landscape? How does their regional identity translate into the territoriality of the geopark? Following this argument, we pose the following question in this paper:

How does the affinity of inhabitants with their living environment compare with the geopark's institutionalization in terms of landscape associations and in a spatial (territorial) sense?

We use a quantitative case study of UNESCO Geopark De Hondsrug in the Netherlands, which was included in the EGN in 2013, to answer the research question. We use questionnaires and mental maps drawn by inhabitants gathered in 2014. The paper is novel in two ways. First, the paper problematizes the residents' support for the geopark and their affinity with the landscape, a perspective that is remarkably understated in current geopark research. Second, we use an innovative methodological approach that consists of cognitive maps processed in a GIS environment combined with insights on the landscape values of people collected from a questionnaire survey. We argue that the approach could be applied as a methodological assessment proposal for UNESCO Geoparks or otherwise protected areas and places of interest.

Following a literature review on community values of landscapes and spatial affinity mapping in natural resource management, we study to what extent the inhabitants' spatial affinity (mis)matches in terms of landscape associations and in a spatial (territorial) sense with the institutionalization of the geopark. Such an analysis with data gathered one year after the inclusion of the geopark in the EGN forms a baseline measurement to, in time, assess the potential of the geopark concept for endogenous regional development.

2. Literature review

2.1. Landscape and community values

Despite geoparks' objectives of anchoring an area's physical landscape with its socio-cultural components and conventions in the awareness of people to reach sustainable development, there are considerable differences in academic landscape interpretations that complicate the study of this enabling role of geoparks. Many geographers interpret landscape as "a synthetic and integrating concept that refers both to a material-physical reality, originating from a continuous dynamic interaction between natural processes and human activity, and to

the immaterial existential values and symbols of which the landscape is the signifier" (Antrop, 2006, p. 188). In this view, landscapes are multi-layered entities of physical landforms, socio-cultural perceptual values and political, discursive actions (Renes, 2015). In contrast to this interpretation, geoscientists (geologists, geomorphologists) predominantly highlight the landforms and processes related to landscape genesis rather than the embedding of communities and socio-cultural institutions in the landscape. This dichotomy in landscape perspectives shows the remarkable continuity of the findings from Zube, Sell, and Taylor (1982). Their literature review identified a dominant expert paradigm in ecology and resource management, where only skilled observers are seen to be able to assess the physical and biological value of landscapes, which contrasts with the experiential focus in geography in which humans are seen as an active participants in landscape creation and valuation (Zube et al., 1982).

With the geopark literature being grounded almost solely in the geosciences, expert-based conservation and promotion of physical landforms has become the main object of study. Yet, geoparks, by definition (EGN, 2000; UNESCO, 2017), target geo(morpho)logical landscapes and landforms in which and with which communities have developed certain uses, habits and sociocultural systems. By doing so, they take up a conceptual middle range position (Castree, 2005) between both research strands.

While still largely absent in geopark studies, a conceptual middle range position has mainstreamed in the related domain of environmental resource management (Cantrill & Senecah, 2001). This scholarly field has made a shift from 'objective', natural science-based analyses to studies that bridge biophysical insights with socially defined landforms and experiential landscape values of people. In this literature, the formation of affinity with landscapes is presented as a transactional process (Zube, 1987). This transaction is not neutral or objective as our experiences, perceptions and knowledge of nature are always mediated through socially, culturally and politically institutionalized filters (Castree, 2005). Combined with personal characteristics of the observer, these filters translate perceptions into landscape values, thereby imbuing meaning into that landscape (Brown, 2005; Stoffelen & Vanneste, 2015). These landscape values influence stakeholders' resource management preferences and their degree of support for conservation measures (Kaltenborn, 1998). Considering the range of possible and potentially conflicting uses and values associated to natural landscapes, integrative landscape management requires incorporating such landscape perceptions and place meanings (Brown, 2013).

Bosak, Boley, and Zaret (2010) show that such perspectives should also be applied to the abiotic landscape. The authors show that the visions of different stakeholders in Montana (United States) and Alberta and British Columbia (Canada) clashed regarding which landscape elements should be included in National Geographic geotourism maps.

These clashes reflect the power imbued in ostensibly neutral landscape institutionalization processes (Bosak et al., 2010). In addition, administrative delineations, for example the boundaries of a geopark, often have imperfect overlaps with the perceived identity areas of inhabitants, which could reduce the local support and efficiency of planning in these territories (Bosworth et al., 2016; Stoffelen & Vanneste, 2016). Geoparks, consequently, should be sensitive to their stakeholders' affinity with the landscape and spatial territory to reach their sustainable development objectives.

2.2. Spatial affinity measurements in landscape management

Following the general advent of qualitative GIS and public participation GIS, sketch mapping techniques have become prevalent in many research disciplines (Boschman & Cubbon, 2014). While traditional land use planning is based on the measuring and mapping of 'objective' landscape features and biophysical landscape characteristics, the mapping of landscape values and perceptions of people has been noted to facilitate the collaboration of the public in nature conservation decision-making (Brown, 2013; Brown, Raymond, & Corcoran, 2015). Brown (2005) identifies three types of analyses that could benefit from such mapping exercises: (i) analysis of the suitability of areas for certain land uses, considering not only biophysical landscape features but also values and perceptions of people who have an interest in the area under question; (ii) analysis of the management of vulnerable natural resources to include local tacit knowledge in conservation practices; (iii) identification of spatial hotspots or coldspots where certain landscape values, place bonds or affinity of people have a high or low density.

Brown et al. (2015) revealed with a case study of South Australia that cognitive maps could be useful for approaching people's association with their living environment. Respondents were asked to draw the boundaries of the area that they identified most with or depended most on in their daily life. Compared to the method of Brown (2005), where respondents were asked to place sticker dots on a base map, such polygon-based drawings provide less information on the different values imbued in the landscape but more explicit information on the cognitive characteristics of people with the selected area including shape, size and direction (Brown et al., 2015). Composite overlap mapping of individual sketch maps (Boschman & Cubbon, 2014; Brennan-Horley & Gibson, 2009) could reveal insights in spatial 'epi-centres' of perceptions or experiences. This technique is used exploratorily by Brennan-Horley and Gibson (2009) to identify cultural districts in Darwin (Australia), and as a direct input to decision-making, for example regarding which part of a nature area to conserve and which part to exploit economically (Brown, 2013).

It has become evident that an assessment of stakeholders' affinity with the landscape and the territory institutionalized by geoparks could provide a basis for more integrative landscape management. In the following sections, we apply this perspective to Geopark De Hondsrug in the Netherlands.

3. Explorative case study: Geopark De Hondsrug

3.1. Study area

The Hondsrug is an elongated ridge with an NNW-SSE orientation in the northeast of the Netherlands (Fig. 2). The Hondsrug is the most distinctive part of a complex set of landforms, originating from the Saalian glacial period (370,000–130,000 years BP), when ice sheets left elongated ridges parallel to their flow direction in the underlying sediments. The resulting glacial megaflutes consist of glacial till with aeolian cover sands that blanketed the area in periglacial conditions during the Weichselian glacial period (115,000–11,700 years BP) (Bregman & Smith, 2012; Rappol, 1984). The parallel ridges, of which the Hondsrug is the longest with 70 km in length and 1.5–6 km in width, are separated by valleys formed by meltwater streams. The

valleys were filled in the Holocene with peat fens and stream deposits (Bregman & Smith, 2012; Rappol, 1984). The Hondsrug forms the largest of such glacial landforms in Europe and is only matched by structures of similar size in Canada. The first evidence of human activity dates from the Weichselian glacial period (Verpoorte, De Loecker, Niekus, & Rensink, 2016), with the first signs of agricultural practices dating from 5000 years BP on the top of the ridges. These prehistoric settlers constructed megalithic tombs and so-called Celtic fields. After the Middle Ages, people permanently settled on the ridges in villages around the arable fields. These settlement types still form the cultural historical basis for the area's current spatial structure of cities and towns (Geopark De Hondsrug, 2018).

Although the ridge can be regarded as a single geomorphological phenomenon, there is some variation in the environmental characteristics. The northern tip (Fig. 2) is narrow and shows a distinctive difference in altitude with its surroundings (Fig. 3). With the city of Groningen (202,000 inhabitants) and the village of Haren, it is an urbanized area. Further south, the area becomes more rural. Just south of Groningen, the relief is less distinct (Fig. 3). Half-way, south-east of the city of Assen, the Hondsrug is part of a number of parallel ridges and is substantially wider than further north. Here, the east side of the ridge is at its steepest with an altitude difference over 15 m over a distance of 1.5 km. The southernmost area is rural with a single mid-sized town (Emmen) and scattered villages. Geologically speaking, the ridge continues but is rather wide and shows a limited relief (Fig. 3).

Governmental and commercial organizations started with the institutionalization of the geopark in the 2000s. This process culminated with accession to the EGN in 2013. The geopark received the UNESCO Global Geopark status in 2015. The organization's objectives are typical for the broader geopark movement:

The aim is to strengthen the economic development of the Hondsrug region, based on the strong regional identity and international appeal which the newly-acquired status brings with it (Geopark De Hondsrug, 2016, p. 9).

In its master plan, the geopark organization identified three core values that underpin its essence. These core values are:

- (i) Geomorphology (ridges, valleys and the relief of the area), with particular attention to glaciation-related landforms
- (ii) Visible archaeology
- (iii) Cultural landscape

The core values are operationalized in four programme lines that describe the geopark's priorities. The programme lines are: (i) identity: strengthening the positive perceptions of visitors and inhabitants; (ii) education: improving the awareness and knowledge of the geopark among visitors and inhabitants; (iii) economic development by improving the brand, strengthening regional marketing and geotourism product development; (iv) conserving the core values of the geopark through management and monitoring (Geopark De Hondsrug, 2016).

3.2. Sampling and data instrument

Similar to Brown and Raymond (2007), we used a combination of a scale-based survey and survey mapping to evaluate how the inhabitants' spatial affinity (mis)matches with the geopark's institutionalization in terms of landscape associations and in a spatial (territorial) sense. We also assessed whether this affinity with the geopark area is dependent on the respondents' landscape associations and their sociodemographic characteristics.

Data were collected in 2014 in the nine municipalities (39 places of residence; Fig. 2) located in the geopark. Considering the differences in landscape morphology (see Figs. 2 and 3) and occupation pattern, we separated the area into four sampling areas ('north urban', 'north rural', 'central rural' and 'south rural'). Face-to-face surveys of randomly

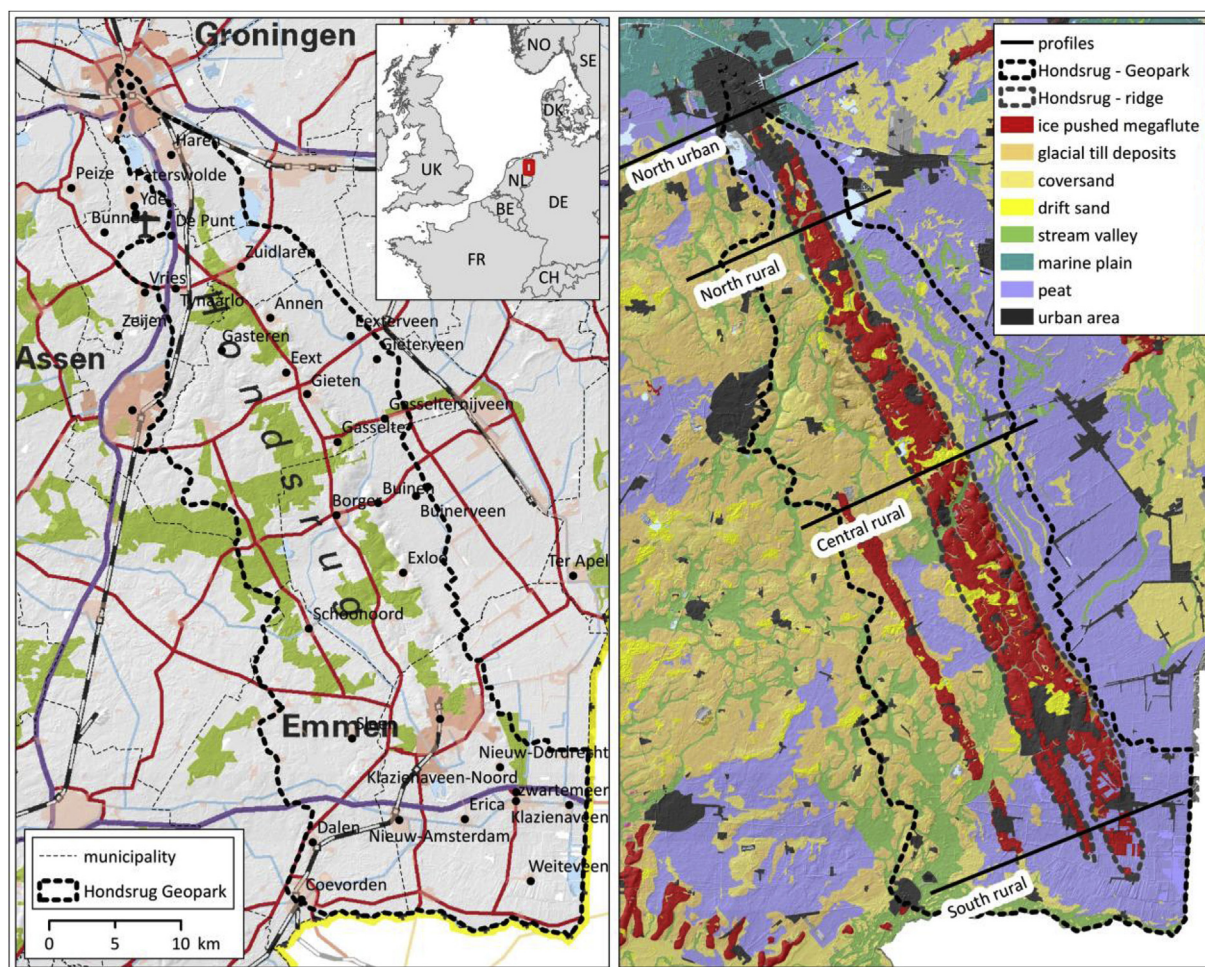


Fig. 2. Study area. The transects on the right indicate the locations where cross-sectional profiles were taken.

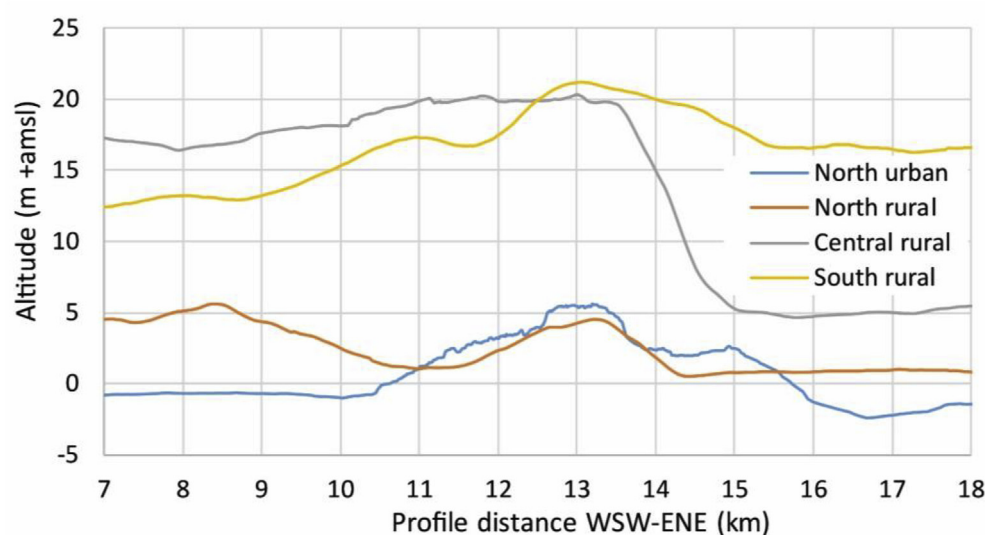


Fig. 3. Cross-sectional profiles of the sample areas, showing the difference in relief.

selected passers-by were conducted in several public locations. These data were combined with surveys gathered from door-to-door canvassing in the smaller villages where on-street sampling proved less fruitful. The survey consisted of 22 closed questions and 7 open questions on the quality of the living environment, the affinity with this area

and the recognition and evaluation of Geopark De Hondsrug. Respondents were also asked to draw the boundaries of the area that they associated with the term 'De Hondsrug' on a base map. The mapping aimed to assess whether the boundaries of the geopark organization reflect cognitive boundaries of the region by the inhabitants and was,

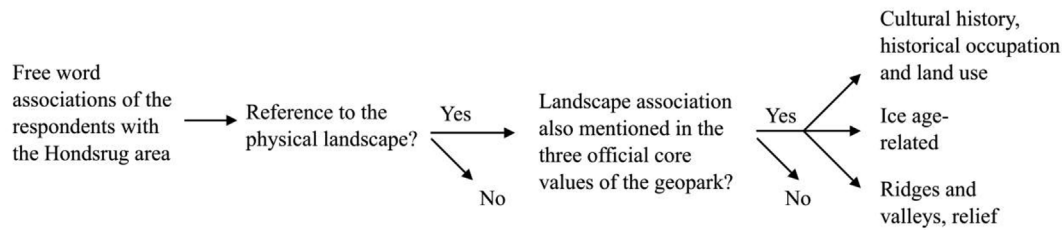


Fig. 4. Decision-tree for the coding of free word associations.

Table 1

Affinity of respondents with the Hondsrug area.

Affinity with the Hondsrug	n	Total ^a	Per sample area				Avg. length of residence (years)	Avg. age of respondents (years)
			North urban (n = 73)	North rural (n = 104)	Central rural (n = 153)	South rural (n = 73)		
1: very weak	40	12%	21%	4%	9%	11%	10.1	33.3
2: weak	68	19%	32%	12%	14%	16%	12.7	41.5
3: neutral	104	27%	29%	24%	24%	30%	22.1	49.4
4: strong	150	33%	16%	50%	41%	33%	25.8	54.7
5: very strong	41	9%	3%	11%	14%	10%	32.3	61.4
Total	403	100%	100%	100%	100%	100%	21.7	49.7

Pearson's Chi-square = 45.46, $p < 0.000$. Some respondents returned incomplete questionnaires, resulting in lower number of responses for this variable.

^a Weighted for population per sampling area.

hence, most aided by free polygon drawing. We did not determine the required sample size a priori. For the used variables the required sample size depends on the variation in the population, which is unknown. We used comparable studies (e.g. Brown, 2005; Brown et al., 2015; Brown & Raymond, 2007) in assuming that a final sample size of about 400 would be large enough for the study. Our significance testing a posteriori (see below) suggests that the sample size was large enough. This was the case also for the subsample for each of the four regions of study. The survey resulted in 427 completed questionnaires and 409 completed maps. One respondent lived outside of the area, so was not placed in one of the four sample areas. The answers of this respondent were, however, included in the overall data.

3.3. Survey analysis

We first descriptively assessed the respondents' level of affinity with the Hondsrug area. We compared the strength of the respondents' affinity for several control variables (age category, place of residence and length of residence in the area). As a reliability check, we ran a regression analysis with attachment to the Hondsrug area as the dependent variable and an extended set of control variables and the person conducting the survey as the independent variables. The resulting model is significant ($F = 44$; $p < 0.000$) but the variable 'person doing the survey' is not significant ($t = -1.47$; $p = 0.14$). The questionnaire is reliable in the sense that the person conducting the survey was not statistically significant in the results.

We then compared the core values of Geopark De Hondsrug with the first three landscape associations mentioned by the respondents in reply to an open question. Since the geoparks' archaeology and cultural landscape core values both cover the interaction of people with the physical landscape, we combined both into one category. We also separated the more general geomorphological descriptions referring to the ridges, valleys and relief from direct mentions of glaciation-related landscapes to match the descriptions on the geopark's website.

Prior to coding the word associations, we validated the decision-tree for the coding process (Fig. 4). The authors independently coded a random sample of 100 entries. We established the rule that the coding should be performed as done by the majority of the coders in the coding validation. The intercoder validity was analysed by calculating

Cronbach's Alpha and by calculating correlations between individual coders, between individual coders and the coding of the entries by the majority of the coders, and between our total score and the final coding decision. All measures were calculated for each step in the coding process. The internal consistency proved high, with high Cronbach's Alphas (> 0.89) for most questions and an acceptable score (0.72) for one step in the coding process. Correlations between the coders were high ($r = 0.88$ for all coded entries by the coders and the final coding decision).

One of the authors then coded all survey entries. The coding resulted in descriptive quantitative information on the thematic overlap between the geoparks' core values and the landscape interpretation of the geopark's residents. Subsequently, we tested if this overlap is influenced by the inhabitants' level of affinity with the area. This way, we analysed how the geopark institutionalizes spatial identity components of the area.

Second, we evaluated how the spatial affinity of the inhabitants (mis)matches with the geopark's institutionalization in a spatial (territorial) sense. The mental maps were scanned and digitized. Composite overlap mapping resulted in a density map of spatial recognition of the Hondsrug area. The drawn polygons were subsequently differentiated according to the four sampling areas based on the place of residence of the respondents. Similar to Brown et al. (2015), one-way ANOVA was used to describe and compare the variability of intragroup geometries of the mapped areas according to the respondents' place of residence.

4. Results

4.1. Spatial affinity and landscape vision of inhabitants of the Hondsrug area

The average strength of the inhabitants' affinity on a five-point Likert scale with 1 being very weak, 3 being neutral and 5 being very strong, has a median of 3. Most responses indicated a rather strong affinity with the area (category 4; 33%), followed by neutral (27%) and rather weak (category 2; 19%) connections to the living environment. These results indicate a moderate regional affinity of inhabitants with the Hondsrug area. The strength of the respondents' affinity seems to relate to their length of residence and age, with older people and people

Table 2
Overlap between the landscape associations of inhabitants and the official landscape vision of Geopark De Hondsrug.

Code	n	Total	Per sample area		Per strength of affinity						
			North urban (n = 226)	North rural (n = 293)	Central rural (n = 349)	South rural (n = 189)	Very weak (n = 104)	Weak (n = 187)	Neutral (n = 273)	Strong (n = 391)	Very strong (n = 105)
Free word associations	1060	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Reference to physical landscape	637	60%	59%	68%	57%	56%	55%	59%	58%	63%	62%
Also mentioned in the geoparks'	340	32%	28%	39%	32%	25%	30%	30%	30%	34%	34%
core values											
Core value 1: cultural landscape	121	11%	7%	12%	13%	14%	8%	8%	11%	14%	15%
Core value 2: ice age	47	4%	6%	4%	5%	3%	6%	4%	5%	5%	2%
Core value 3: ridges and valleys, relief	172	16%	16%	23%	15%	9%	16%	18%	15%	16%	17%

Table 3

Descriptive statistics and ANOVA of the geometrical characteristics of the mental map polygons for the four sampling areas.

Polygon	Place of residence	N	mean	st. dev.	st. err.	test statistics	
						F	Sig.
width (km)	North urban	75	9.9	5.4	0.6	2.961	0.032
	North rural	101	10.5	6.8	0.7		
	Central rural	156	12.5	8.1	0.6		
	South rural	76	11.9	7.2	0.8		
length (km)	North urban	408	11.4	7.2	0.4	3.216	0.023
	North rural	75	42.0	14.6	1.7		
	Central rural	101	35.4	15.4	1.5		
	South rural	156	37.7	16.2	1.3		
length-width ratio (–)	North urban	76	35.3	15.3	1.8	4.738	0.003
	North rural	408	37.4	15.7	0.8		
	Central rural	75	0.28	0.19	0.02		
	South rural	101	0.35	0.22	0.02		
Orientation (°)	Central rural	156	0.40	0.26	0.02	1.661	0.175
	South rural	76	0.38	0.22	0.03		
	North urban	408	0.36	0.24	0.01		
	North rural	75	143	32	4		
x-coordinate centroid (RD ^a ; km)	North rural	101	137	46	5	31.035	< 0.000
	Central rural	156	130	50	4		
	South rural	76	132	50	6		
	North urban	408	135	46	2		
y-coordinate centroid (RD ^a ; km)	North urban	75	246.4	4.6	0.53	36.382	< 0.000
	North rural	101	244.1	4.6	0.46		
	Central rural	156	247.0	4.2	0.34		
	South rural	76	250.8	5.1	0.59		
	North urban	408	246.9	5.0	0.25		
	North rural	75	553.6	10.0	1.16		
	Central rural	101	556.4	7.1	0.71		
	South rural	156	551.4	5.4	0.44		
	North urban	76	544.8	8.6	0.98		
	North rural	408	551.8	8.4	0.42		

^a Rijksdriehoekstel: Dutch national coordinate system, in km.

who have lived in the area for a longer period of time having a higher affinity with the area (Table 1).

A Chi-squared test shows that there is a statistically significant difference between the strength of the respondents' affinity and the sampling area (Pearson's Chi-square = 45.46, $p < 0.000$). The respondents in the 'north urban' and 'south rural' areas have the weakest affinity. In the 'north urban' area, the physical landscape is poorly visible due to the built-up character of the landscape (Section 3.1). Additionally, with Groningen being an important student city, the age structure is different, which could lead to different interpretations of and affinity with the area. In the 'south rural' area, the limited topographical visibility could influence the relatively low affinity of the respondents. However, the visibility of the terrain relief does not explain everything as the difference in altitude and the steepness of the terrain in the 'north rural' area are limited and comparable to the 'north urban' area, yet the affinity of people with the Hondsrug is large in this group (Table 1).

People do seem to moderately agree that the landforms and relief are at the basis of the uniqueness of the Hondsrug area (Table 2), with 60% of the landscape associations made by the respondents referring to the physical landscape. Roughly half of these associations refer to the three official core values of the geopark. The other associations mostly relate to nature ($n = 100$), forest ($n = 69$), diverse and sometimes very specific descriptions such as 'juniper' or 'high water levels' ($n = 51$), and sandy soils ($n = 48$). Respondents linked the physical landscape only to a limited degree to glaciation-related processes. Only 4% of the inhabitants' landscape associations overlapped with this core value, constituting just 14% of all physical landscape-related landscape associations. This is remarkable considering that glaciation-related landscape elements are not only central in the geopark's communication but are arguably the most important pillar under the right of existence of the geopark. While the landscape associations mentioned by people

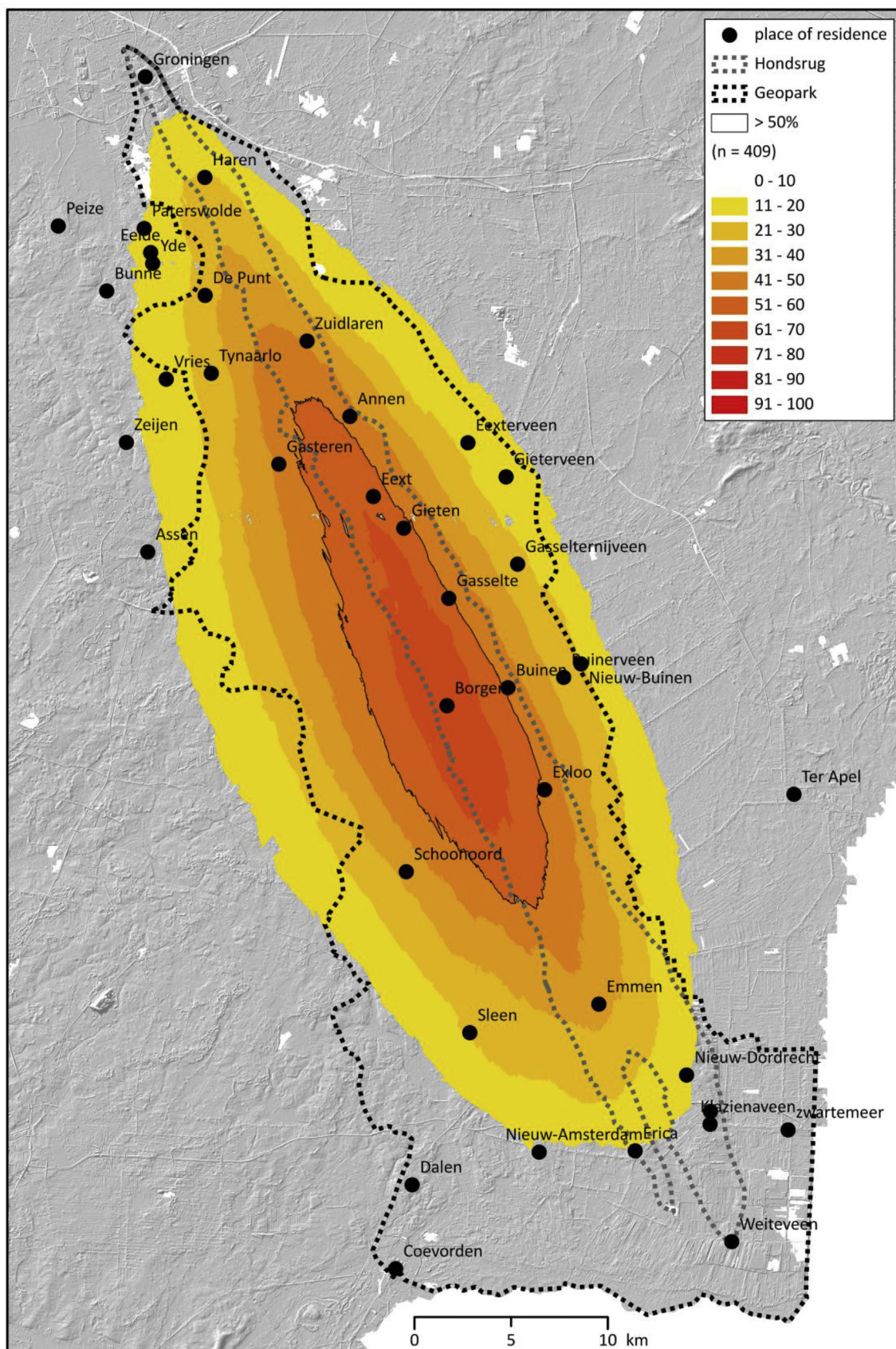


Fig. 5. Composite overlap map of all respondents (weighted for population per sampling area) and comparison to the administrative geopark delineation and the Hondsrug landform.

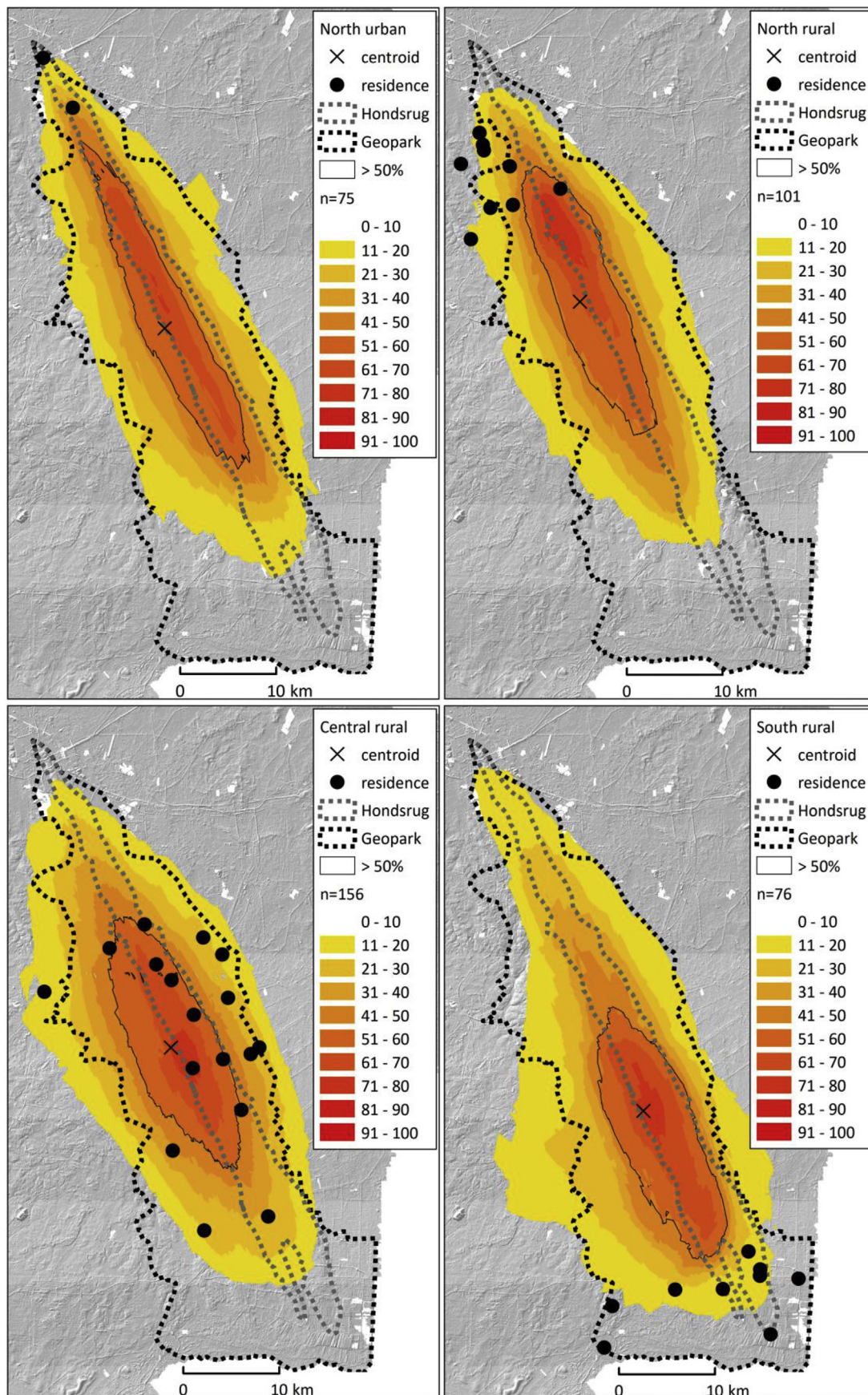


Fig. 6. Mental map counts per place of residence.

with a strong affinity did match more closely with the geopark's vision regarding the 'cultural landscape' core value than among people with a weaker affinity, no pattern was discernible for 'ridges, valleys and relief'. There was even a reversed trend regarding the glaciation core value, with very low recognition of glaciation-related landforms and processes among the group with the strongest affinity. The length of residence and age of the respondents do not seem to influence the vision on what constitutes the Hondsrug area.

While the pattern of the respondents' landscape associations matches between the four sampling areas, the landscape vision of the respondents in the 'south rural' area overlaps least with the official vision of the geopark. These respondents particularly mention the relief and altitude differences less as a key characteristic than respondents in other sample areas.

4.2. Territorial association of inhabitants with the Hondsrug area

Fig. 5 shows the density maps of the aggregated sketch maps compared to the boundary of the geopark and the Hondsrug landform. Fig. 6 shows the composite overlap maps per sampling area. All maps show a similar spatial pattern, with the 'majority polygon' (the polygon in which 50% of the respondents indicate that the area constitutes the Hondsrug) being located within the geopark's boundaries. The majority polygons hug the eastern edge of the Hondsrug landform. They do not match as closely with the western edge of the Hondsrug landform, which corresponds with the lower visibility in the physical landscape (Fig. 3). All majority polygons are substantially smaller than the geopark's territory.

ANOVA tests of the correspondence between the geometric characteristics of the mental maps and the respondents' place of residence show that the place of residence influences residents' territorial recognition of the Hondsrug (see Table 3). The one exception is the compass orientation of the Hondsrug, which does not differ statistically between groups. Based on the x and y coordinates of the mental map centroids, people tend to draw the Hondsrug closer to their homes: people in the northern sampling areas draw the centroid further north than people who live more to the south. The centroids for the 'north urban' and 'south rural' areas are 13 km apart.

While the core of the geopark is widely recognized as being part of the Hondsrug, the northern and southern parts of the geopark are not part of the majority polygons. The southern part is included in less than 10% of the mental maps, meaning that this part of the geopark does not feature in the inhabitants' territorial association with the area. These results from the mental maps conform to the scale-based survey measurement presented in Table 1.

5. Discussion and conclusion

Even though geoparks strive for anchoring the physical landscape of an area with its socio-cultural components and conventions in the awareness of people, academic studies have predominantly focused on geophysical landforms rather than the visions of people living in these places. In this paper, we argue that the scant academic attention to communities and their geographical perceptions undermines the objective of geoparks to foster endogenous regional development.

The case study of Geopark De Hondsrug has shown a complex image regarding the affinity of the inhabitants with their living environment. At its initiation, the geopark did not build on the local inhabitants' landscape associations. This was particularly clear for the geopark's most important core value to which it, arguably, owes its UNESCO Global Geopark status: the landscape's glaciation-related origin. There are opportunities for connecting more to nature conservation areas, such as the adjacent National Landscape Drentsche Aa, considering the inhabitants' strong landscape associations with the nature of the geopark area. From a territorial perspective, the geopark incorporates and communicates an area that is substantially larger than the area

interpreted by the inhabitants as constituting the Hondsrug. That is not necessarily a problem, as the landform stands out as clearly visible from the surrounding areas, particularly in the east. The central area of the geopark brand is also recognized and lived by the majority of the people in the area. The main issue lies in the northern, more urban end of the geopark which is also characterized by a younger age structure, and, particularly, the southern end which has a limited topographical visibility.

These findings have implications as to the objectives of the geopark organization. The results, for example regarding the consensus about the core of the Hondsrug region and its compass direction, do give indications that some (predominantly spatial) recognition of the Hondsrug is present among the community, even though the affinity of people with the area was not very strong. It would be interesting to see if and how the geopark's actions to protect and promote the area's landscape have resulted in an increase of the local support and recognition of the area since its inception and the moment of data collection for this paper. Previous research has shown that internal marketing of area-specific histories and narratives can be successful in improving community support for regional development policies and place branding efforts when there is an endogenous, latently present identity to build on (Stoffelen & Vanneste, 2018). For the Hondsrug, these findings entail that the geopark should focus on the internal embedding of its core values rather than communication of these core values to the outside. Practically, the inhabitants' affinity and landscape interpretation should be triggered in a different way than just communicating about the glaciation history as this core value showed to be weakly recognized.

In other words, to reach the geopark's third programme line (economic development by improving the brand, see 3.1), the first and second programme lines (identity and education) should get priority. This call resonates with the UNESCO's review committee assessment of the geopark's functioning (UNESCO, 2018). In this internal document, the review committee positively assessed the geopark's actions but also recommended strengthening its educational actions and increasing the visibility of the geopark's logo and interpretative facilities for visitors. Our study's results show that there seems particularly much to gain from engaging with younger age groups. Longitudinal follow-up research is necessary to clarify if the level of affinity is only the result of an intrinsic effect of age and length of residency or if the geopark's internal actions, particularly targeted at the younger age groups, may have any effect. Only when there is enough bottom-up recognition and embedding of the brand and its underlying landscape values, the geopark's glaciation narrative can be effectively built on for endogenous regional development. Now that Geopark De Hondsrug has reached a level of maturity several years after its inception, follow-up research with a similar focus could uncover if the first steps have been made in this regard.

Acknowledgements

The Bachelor and Master students Jan Jelmer Meijer, Amarinske Verkerk, Mathijs ter Horst, Mark Reysoo, Bartelee van der Meer, Daan Haanstra, David van Ommen, Ewout van Spijker, Rik Huizinga, Evelyn Dobbinga and Berber Oosterhagen are thanked for their efforts and contributions in data gathering and analysis and the many fruitful discussions. The authors would also like to thank the anonymous reviewers for their constructive feedback.

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